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Journal of the Society of Arts.

FRIDAY, AUGUST 8, 1856.

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ASSISTANT-OBSERVER AT KEW OBSERVATORY.

The managers of the Kew Observatory, having applied to the Council of the Society to recommend to them one of their candidates at the late examination, qualified to undertake the duties of Assistant-Observer, the Council have nominated Mr. Charles Chambers, of Leeds, who has, accordingly, been appointed to the office.

Mr. Chambers obtained a certificate of the first grade in Mathematics, at the examination held in June last.

ON NEGATIVE ARTESIAN WELLS, OR ABSORBING BORED WELLS, AS A MEANS OF DRAINING LANDS, FARMS, BUILDINGS, &c.*

By Augustus Edward Bruckmann, Ph. Dr., Consulting Engineer and Geologist.

(*Continued from page* 626.)

Second Division.

Negative artesian wells in the Molasse and Jura formation, for the drainage of the ale-cellars at Stetten, above Lonthal, belonging to the Count Maldeghem; with preliminary remarks.

The idea of reaching, by means of borings, strata through which marshy grounds or fens, or even ponds and lakes, may be laid dry, and by which superfluous or injurious water in general may be permanently got rid of, is not altogether a new one, as we have seen from the preceding disquisition; but the establishment of absorbing bore-holes has not been by any means so often realised as that of true artesian wells, although many formations and localities are better qualified for the execution of the former than of the latter. How many useless borings for rising spring-water have been already undertaken in highly-elevated countries and disruptured rocks, where, instead of getting rising springs, not unfrequently absorbent veins have been disclosed, which received and carried off the waters found in the superincumbent beds. Such attempts have proceeded either from ignorance or want of principle in those who undertook them, and who, only grasping at money, were careless of the results of their performances, their credit, and reputation. Out of several warning facts well known to me, I have made particular mention of only a single one in the first division of this paper. It is deeply to be regretted that such vast sums should have been wasted in such preposterous attempts.

About twenty-five years ago, when I had introduced artesian wells into Bavaria, among other engagements I was invited by the authorities of Pothenstein to travel to Gössweinstein, where they desired to establish a boring for rising spring-water. After I had examined the local conditions and formations of the place, I at once advised the relinquishing of the project, pointing out the impossibility of success; for Gössweinstein is about as highly elevated as the romantic rock of Lichtenstein, in Wirtemberg (now belonging to the Count William of Wirtemberg). The prevailing formation is the same—fissured coral rag; and at the foot of the rock, in the adjacent valley below Gössweinstein, three very abundant fresh-water springs break forth, similar to the sources of the Echatz, above Honau, near Lichtenstein; of the Blautopf, near Blaubeuren; of the Brenz, near Königsbronn; of the Kocher, near Aalen, &c., in Wirtemberg. I have also met with analogous phenomena in the elevated town of Rottenburg, on the Tauber, in Bavaria, situated on the upper shelly limestone, and in several other places; and, as a matter of course, I there also pointed out the impossibility of establishing artesian wells.

Under such circumstances, it would have been absurd and unprincipled to express even the least hope that borings for rising spring-water would be successful; the deeply-situated and copious outbreaks of springs existing there are the result of the atmospheric waters condensing, precipitating, and infiltrating on the plateaus in the environs and sinking down in the clefts of the stones, till they meet an obstacle—a basis impervious to water—which prevents their sinking down further, and forces them to break out in the form of springs. Thus, the mountains themselves are tapped by nature.

It does not properly come within the province of the present paper to explain how drinking-water can be procured in formations and situations in which artesian wells never can be executed with success,—such as by the establishment of bored, pump, or draw-wells, on elevated plains, highlands, or mountains; or, according to circumstances, by erecting "spring tanks,"* sinking shafts, tunneling, &c. On this point I may refer to my former publications† and practical works.

I would refer, for example, to the fissured upper coral rag, in which, under certain conditions, rising springs can never be met with; yet this rock, besides being useful for building and other purposes, is valuable for the permanent removal of the superfluous water, which not unfrequently accumulates in the more recent superposed clayey and marly ground.

According to my own experience, the jurassic or oolitic formation in general, even in its middle deposits, is more fitted for establishing absorbing borings than true artesian wells. Thus, for instance, about seventeen years ago, at Müllheim, in the Brisgau, I bored in it to a depth of 482 feet, without meeting with rising spring-water at this depth. The perforation was made in Oxford clay, lying upon Bradford clay,‡ and a description of that boring may be found in the appendix to my German edition of Viollet's "Théorie des Puits Artésiens," already quoted, pp. 217-220 and pp. 223-229, where I have also described the serious difficulties and accidents which occurred during the course of this perforation, and the means by which I overcame them. Nevertheless, this boring, not yet finished, and only stopped for the present, bids fair, judging by the situation of Müllheim, to furnish rising spring-water, if the perforation be continued to the subjacent great oolite. In addition, I must remark that, in the lower division of the jurassic deposits, principally in the *Lias* (black jura), some artesian wells have successfully been established in Germany.

I shall now describe two successful negative artesian wells which I have lately executed.

His Excellency the Count of Maldeghem, lord of the manor of Niederstotzingen, &c., desired, towards the close of the year 1852, to have a positive artesian well established in the grounds of his castle at Niederstotzingen, after a former boring for spring-water, undertaken there by another engineer, had entirely failed. Above all, he wished to have the advice of an accredited and experienced engineer, and addressed himself upon this subject to the Royal Counsellor of Mines, Herr von Schübler,[*] in Stuttgart. This gentleman was kind enough to recommend and propose me for the purpose in question, and I was invited by the Count to travel from Darmstadt, in Hessia, where I then lived, to Niederstotzingen, to undertake the necessary geological and hydrographical preliminary researches. Unfortunately I could give no hope of success, for the somewhat elevated grounds of the castle, although covered with some miocene fresh-water and molasse-marls of trifling thickness, had the fissured and absorbent coral rag[†] for a basis. I therefore at once dissuaded the Count from attempting the execution of an artesian well. But, in order to procure the desired spring in another way, the chief object of which was to feed a pond, I pointed out on the hill of molasse[‡] rising at the back and towards the north, where, besides, some spring-tanks (Brunnenstaben) had been already established, two spots on which some other such tanks might successfully be formed, and from which the water might be led to the neighbouring grounds of the castle by means of pipes. I had already tried the same plan under less favourable circumstances, in the year 1836, at Zwintemberg, a private estate of his Majesty King William I. of Wirtemberg, where I nevertheless succeeded in establishing a spring tank in the alpine diluvium,[§] out of which, ever since, an abundant supply of good drinking-water, through a series of water-pipes, flows to the neighbouring farm, which formerly had nothing but a common pump-well, with such bad water that even the cattle refused to drink it. In precisely the same way, and in the very same deposit (alpine diluvium), in the year 1846, I was fortunate enough to establish for the Count of Langenstein, at the castle of Langenstein, near Stokach, in the Grand Duchy of Baden, a tank which now supplies that castle, situated on an almost entirely isolated rock of coral rag, with good drinking-water in even a greater quantity than is required. There also I refused to bore for rising spring-water, for reasons which I have already given.

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* German: "Brunnenstaben."

† See. for example, pp. 284-290 in my appendix to the German edition of Viollet's "Théorie des Puits Artésiens"—"Meber Arlegung gebohrter Schöpfbrunnen auf Hochebenen und Bergen."

‡ Compare "Die Jura-Formationen des Breisganes geognostisch beschrieben von Carl Fromberg, Dr. der Medicin, ordentl. öffentlichem Professor der Chemie und Mineralogie au der Universität zu Freiburg, Mitglied, &c. Mit zwei geognostischen Karten. Karlsruhe, 1838. Verlag von Christian Theodor Groos."

After the Count of Maldeghem saw, by the report which I gave him, that there was no hope of obtaining an artesian well in the grounds of his castle, he took me to the village of Stetten, above Lonthal, where he, among other properties, possesses a large brewery, the excellent ale of which is well known to the whole kingdom of Wirtemberg under the name of "Stotzinger beer."

When I arrived at Stetten, the Count drew my attention to the vexatious circumstance that water was always finding its way into both his strong-ale-cellars, which they were obliged partly to pump out and partly to draw out, in casks, at short intervals, at great expense, and with great loss of time, with considerable damage in other ways—damages to which all wet beer-cellars are liable.

It is essentially important to draw attention to the circumstance, proved by experience, that in a wet cellar mould forms on the casks, whereby the soundness of the wood is injured, and in a short time the wooden hoops get rotten, break, and fall off. Besides, if water gets into cellars, the temperature in them is raised,[*] and this operates injuriously upon the ale in two ways; for,

1. The evaporation of the water injures the quality of the beer, so that it is spoiled, loses its keeping property, turns flat, or becomes thick.

2. In summer time, no higher temperature should prevail in a strong-beer cellar (at least in the opinion of German brewers) than 5° to 6° Reaumur; whilst, in a winter-beer cellar, it may be allowed to increase to 8° or 10°, without injuring the beer. Nay, in winter time, we often see the air-holes of strong-beer cellars opened, in order to bring their temperature, if possible, to the freezing point, or, as German brewers say, *in order to have the cellars thoroughly frozen.*[†]

The dry rot of casks injuring the wood of the staves, and by degrees even destroying it, forms rapidly in every cellar which is too warm, even if it be dry, and the staves are made of the best wood. By establishing a current of air, however, together with a proper temperature, it can for the most part be prevented. During my practice, I once met with so interesting a case, that a short description of it may be allowed here.

Near the village of Staad, not far from the town of Constance, on the borders of the lake Constance, there is a large strong-beer-cellar cut out in a loose but dry rock of molasse, which, on its first establishment, was one of the best cellars to be found in the environs. But, not long afterwards, the proprietor, a Mr. Schalk, who, some years ago, successfully established himself as a brewer in North America, made the disagreeable discovery that the dry rot began to appear on the casks deposited there. I at that time (between 1840 and 1847) lived at Constance, and was municipal architect and teacher at the Technological Institution of that place, and likewise architect of the Count of Langenstein. Mr. Schalk invited me to examine into the matter, and, if possible, to remove the evil. I went with the proprietor to the spot. On the north side of the entrance to the cellar, at the bottom, on the right and left, there were two air-holes constructed, which could be opened and shut at pleasure. In the middle of the cellar-arch, cut out in the solid molasse, there was a wide perpendicular air-shaft, which, as I had been told, reached above the surface of the superincumbent soil, that is, above the open arable land. As soon as I entered the cellar, I was struck by the close atmosphere which prevailed in it. Both the air-holes of the north side were opened; we had torches and candles with us, but not the least movement of their flames was to be perceived—no draught in the whole large space of the cellar.

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[*] This gentleman was one of my examiners, in the year 1835.

[†] Overlying this rock, I found in the environs, here and there, marly Portland stone, which Auerstedt identifies with the lithographic limestone of Solenhofen and Pappenheim, in Bavaria, and calls it "Krebbsscheerenkalk" (limestone with crab's claws). See his "Flötzgebirge Württembergs."

[‡] This locality is well known to German geologists for its abundance of fossils. Bivalves do not often occur, it is true. with both their shells; and of the genera "Cardium" and "Cytherea" I found only casts; but beautiful specimens of Ostrea longirostris, Lmrk. (very common); O. cyathula, Lmrk.; O. flabellula, Lmrk; O. mutabilis, Desh; Pecten crassicostatus, Dunker; P. Hermanseni, Dkr., are to be met with.

[§] Compare page 10 of my work, "Der wassereiche artesische Brunnen im alpinischen Diluvium des oberschwäbischen Hochlandes zu Isny, in geognostisch-hydrographischer und constructiver Hinsicht. Nebsteinem Beitrage zur Kenntniss der Diluvialgerölle der Bodenseegegend. Mit einer lith. Gebirgsdurchnitts-zeichnung. Stuttgart. E. Schweizerbart'sche Veragshandlung und Druckerei. 1851." A review of this book is to be found in the "Heidelberger Zahrbücher der Literatur, Num. 20, 1851, pp. 312-313."

[*] It is well known in Germany and France that my father invented and introduced the application of the waters of artesian wells for the purpose of warming workmen's rooms in manufactories, and of melting the ice entirely from water-wheels, and communicated his discovery to the "Société d'Encouragement pour l'Industrie Nationale à Paris." See "Rapport fait par M. Héricart de Thury, au nom du comité des arts mécaniques, sur l'application des eaux des puits forés dans les usines et dans les ateliers, par M. de Bruckmann, architecte du Roi de Württemberg," in the bulletin of this Society of the year 1831, for August, p. 380, &c. Or compare pp. 26-63 of the first quoted work, "Vollständige Anleitung zur Anlage, Fertigung und neueren Nutzanwendung der gebohrten oder sogenannten artesischen Brunnen." It will be found in those pages that, by means of the waters of artesian wells, hot-houses may also be warmed and winter gardens established, and that, conversely, the water in ponds and lakes, when it is too warm in summer time, may be cooled by the waters of artesian wells led into them, to prevent the fish from dying. Besides, see pp. 36-37, in "Le Puits Artésien de Grenelle, par M. Rey. Quatrième édition. Paris (Quai Malaquais, 15), 1845." The "Société d'Encouragement pour l'Industrie Nationale à Paris" bestowed upon my father, at the general meeting of the 29th of June, 1832, a gold medal for this invention and the communication of it to them.

[†] German: "Um die Keller ausfrieren zu lassen."

I immediately presumed from this observation that the upper air-shaft was entirely stopped. The owner protested against my opinion, and even maintained that its stoppage was an impossibility, observing that the mouth of this air-shaft, on the open arable field, was always kept open, and secured in a proper manner. In spite of these remarks, I insisted upon its being examined carefully. Ladders were brought, I ascended, and what did I discover? The air-shaft, in its upper part, was entirely laid over with deal boards, and a layer of mould thrown upon them, over which even the plough of the farmer had passed; in short, it had been closed hermetically.

What had hitherto been a riddle was now solved to the perfect satisfaction of the proprietor. Measures were taken for keeping open this air-shaft in future; the dry-rot disappeared, and since that time the cellar in question has again become one of the best establishments of its kind.

After this short digression, let us return to Stetten, above Lonthal.

The Count of Maldeghem, well knowing the advantages of dry cellars and the disadvantages of wet ones, inquired of me whether the injurious water which entered into both his ale-cellars could be effectually removed? I answered this question in the affirmative, proposing the establishment of absorbing bored wells. After I had explained the system, and its very probable success, I was requested to put my idea into execution.

Before I describe these successful borings themselves, I will give a geological and hydrographical description of Stetten, according to my own researches.

Stetten, above Lonthal, a catholic village of about 350 inhabitants, situated in the rather elevated bailiwick of Ulm, in the kingdom of Wirtemberg, lies upon the southern gentle descent of the jurassic rugged Suabian Alps, and at a short distance the valley of the Danube, chiefly forming a boggy country, extends towards the kingdom of Bavaria. Near Stetten there is the low-lying and rather narrow Lonthal (valley of the Lone), through which a rivulet winds, called "Lone," or "Lontel," traversing the bailiwick from west to east. The village lies partly on the western slope of the so-called "Gemeinde" (an ascent of a hill, in terraces), partly in a narrow little valley, from which rises, in a western direction, the higher "Stumphau." Further back, however, is the high alpine village of "Bissingen." Towards the east, the ascent of the "Gemeinde"—a hill, on the top of which both the Count's strong-beer cellars are built—leads into a plateau of fir wood, the surface of which, gradually rising about 25 feet, unites with the "Sandfield," the before-mentioned molasse of Niederstotzingen. The latter locality lies 1,855 Wirtemberg feet above the level of the sea, and about 200 feet above the neighbouring Danube, so that the elevation of the strong-beer-cellars in question may be approximately given as 1,830 feet above the level of the sea.

Towards the south, the small valley of the village runs along, first rising, then falling between the villages of Asselfingen and Oberstotzingen, and uniting with the plain of the Danube. Towards the north, the narrow valley in the so-called "Wiese" (meadow), under the castle, and the "Niederfeld" (low field), gradually descends to the Lonthal.

From the northern end of Stetten, in an eastern direction, a narrow little valley, "Reitschule und Brunnenwiese," runs nearly a mile upwards to the Sparrenwald (a wood), and passes by degrees into the plateau of the Sandfield, where, as I have already shown, the marine molasse of Niederstotzingen, with its large ostracites, &c., is deposited. Ascending this little valley from the village, we find it bounded on the right hand (southerly) by the fir wood before spoken of, and on the left by the "Stehberg," "Büschelesberg," &c., which all pass into the "Sandfield" further up.

At the bottom of the Stebberg, and for a short distance also at the bottom of the fir-wood, hard fissured coral rag crops out; the same rock is to be seen at the western and northern foot of the "Gemeinde" (already mentioned), and on its northern descent we find it partly covered with Portland stone, alternating with compact marls. The middle division of this hill upon which I undertook the absorbent borings, consists of the upper fresh-water bed, and the uppermost one of marls belonging to the molasse, which latter, in a thin bed, extends from the "Sandfield" to this place. As for the rest, the hills and mountains of the environs chiefly consist of coral rag, which, covered with Portland stone, is exposed in the large quarry of the neighbouring village of Oberstotzingen, becoming sometimes oolitic, as at Schnaitheim, in Wirtemberg, and, besides its known characteristic fossils, enclosing nodules of horn-stone and crystals of quartz and chalcedony. I found there—*Astraea alevolata* and *heliantoides*, Goldfuss; *Terebratula biplicata*, Sou ; *T. difformis*, Lmrk.; *Pecten*, and *Nerinea* species.

The prevailing character of the coral rag of all the environs, (which is of a whitish, grayish, and yellowish colour, but not often reddish,* and contains not unfrequently veins of calc spar), is—extreme hardness, with extensive irregular disruptions, concavities and land-slips. In the deeper lying part of the village of Stetten itself, there are found, in the tile-kiln and near it, so-called land-slips, but which, according to my own observation, are nothing but, large clefts in the coral rag. Rain-water flowing into them, as well as any water purposely poured in, runs down rapidly and disappears, combining with the system of springs in the deeper lying Lonthal. Among the larger caverns in the limestone, the "Hohle Stein" (hollow stone) and the "Stadel," on the common land of Asselfingen, two miles from Stetten, are distinguished; but also nearer the latter village, in a north-western direction, at the "Vogelherde (fowling floor), on the road to the alpine village of Bissingen, there is a somewhat extensive, but low cavern, with stalactites.

At the northern end of Stetten the Count's castle, the church, and the brewery are romantically situated, upon a rock of coral rag, rapidly descending to the adjacent valley of the "Wiese."

The descent of the "Gemeinde," the elevation of which above the level of the sea I have given as 1830 feet, amounts to 70 feet measured from the strong-beer-cellars in a western direction, with a horizontal length of 700 feet to the school house in Stetten; but from that spot a further descent of the ground in the village takes place towards the tile-kiln, &c., in general to the little valley of Stetten.

The coral rag surrounds the western and northern base of the hill of the "Gemeinde" like a belt; it gently and irregularly falls away from south-west to north-east, and the molasse, together with its subordinate fresh-water beds, seems to have been stopped by it. In the perforation in front of the new ale-cellar, the coral rag was only reached at a depth of 76 feet 1 inch and 8 lines, while it rises much higher at the bottom of the "Gemeinde."

The plateaus and slopes of the mountains in the nearest environs are covered with extensive oak forests, rarely with beech and fir. These forests, undoubtedly, cause the condensation and infiltration of a great quantity of aqueous vapours, and I attribute to this circumstance the existence of the springs pervading the upper and more recent strata of the ground near Stetten, as will shortly be shown. The percolation of the injurious waters into both the beer-cellars in question is occasioned by that phenomenon. What important influence forests exert upon the formation of springs, and what detrimental effect is created by rooting out and destroying forests, I have shown in my works already published, enumerating several striking facts with reference to the continent of Europe* as well as America, and I must refer to them for brevity's sake; but, in making such observations, we must be on our guard against taking *inorganic* springs for *organic ones*,† since the latter are entirely independent of the vegetable relations of a country.

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* At the mountain of the old mountain-castle of "Kaltenburg," joining the Lonthal, there are yellowish and reddish masses to be found, spotted like marble, and called "Wild Marble." The Belvidere in the garden of the castle at Niederstotzingen is chiefly built of this material.

Stetten has a privilege not enjoyed by many villages of the Swabian Alps, that is, a clear, wholesome, and abundantly-flowing drinking water. There are five chief springs there, enclosed in tanks, which conduct the required water supply to the village and the Count's brewery by a series of water pipes, and four of them lie not far from the new strong-beer-cellar, on the northern border of the fir-wood at that place, and only a little below the general ground level of the "Gemeinde." All these springs arise from the strata of molasse, between sandstone and marl, and sometimes carry sand with them, which they deposit. Somewhat further up there is a pond, for the purpose of steeping wooden conduit pipes; it is fed by little springs, entering on the north side, and likewise rising out of strata of molasse. This pond serves, besides the purpose of preserving the wooden conduit pipes, as a reservoir in case of fire. Ten minutes' walk in a north-eastern direction from the new cellar, the fifth chief spring, "Schlossfeldquelle" by name, in the "Buschelesteich," arises from the same formation, and, enclosed in a tank, is connected with the others by water pipes, and has about the same level as this cellar.

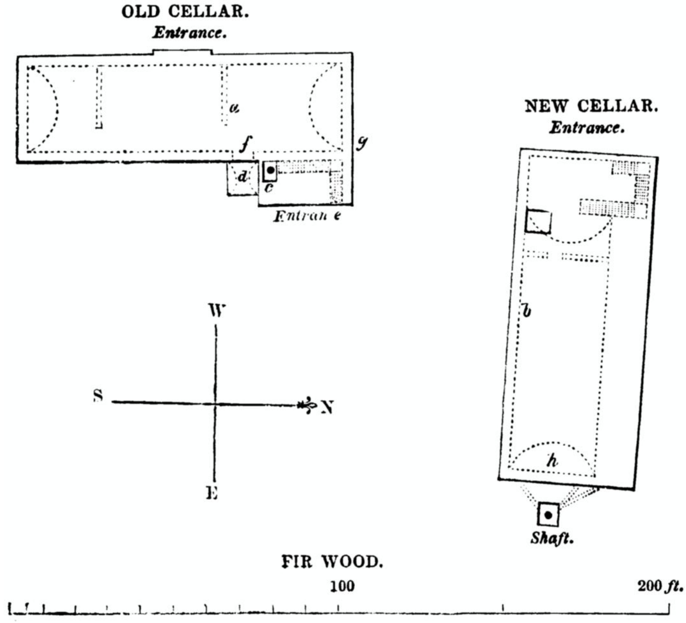
The superfluous water of the oveflowing wells of Stetten and of the pond, winds through a little valley, called "Niederfeld," to the Lonthal. Besides these springs, no other flowing water is to be found near the village, except the Lone in the Lonthal.

The springs in question form a peculiar system, all coming forth from the boundary line of the marine molasse and its fresh-water deposit, and having no connexion at all with the subjacent jurassic rocks. Although it was apprehended, as I was told, that by my borings the aforesaid springs might be impaired in their quantity, or, perhaps, dried up, yet I was able at once to contradict this notion, and experience has shown that I was right. It would lead me too far to speak more on this subject, and to explain it further by geological and hydrographical sections, but I cannot withhold the general remark, that in projects to obtain drinking water under certain geological conditions, it is often very advisable to operate only in the upper ground, instead of going down to a greater depth.

We will now proceed to the description of the absorbing bored wells.

Plate I. is a plan of the situation of both the count's strong-beer-cellars, of which the old one was built in the year 1832, the new one in the year 1834. They lie near the upper edge of the "Gemeinde," already several times mentioned, where the plateau of the fir-wood begins, and in an elevation of 1830 feet above the level of the sea, as we already know, 70 feet above the ground of the school-house in Stetten, and in a horizontal direction 700 feet distant from it. The troublesome and continued penetration of the water into the cellars took place from the east side of the fir-wood, whilst from the west no percolation could be perceived at all, and scarcely any traces of infiltration were to be discovered on the south and north sides of the cellars. Under these circumstances I considered it most advisable to cut off and turn aside the water on the outside of the new beer cellar, by a shaft to be sunk in an eastern direction, before I began carrying down a perforation in which the waters were to fall and sink, and so much the more, as a boring in this cellar itself could never have prevented its eastern and high retaining wall* from being wetted injuriously. On the 27th September, 1852, I arrived at Stetten, after my boring apparatus had already been taken there, and immediately gave the necessary instructions for the preliminary measures. Although the boring in the old strong-beer-cellar was performed during the sinking of the shaft in front of the new cellar, I shall first describe the latter work, being the most important:—

GROUND PLAN OF THE CELLARS.—Plate I.



At a distance of 6 feet from its eastern retaining wall, which is 27 feet 3 inches high (see Plan I), a shaft, six-feet square, was sunk to a depth of 33 feet, in a thoroughly solid manner, in order not to injure the high retaining wall close by; thus the bottom of the shaft was laid almost 6 feet deeper than that of the cellar. A description of the geological strata cut through will be given further on, and here I meanwhile remark, that at a depth of 19 feet, the first percolating water was discovered entering from the east-side, and increasing as the shaft was sunk deeper; but this water came in only at a depth of between 19 and 25 feet, out of a bed of fresh-water marl, while the ground above and below was dry. After the shaft was carried down to a depth of full 20 feet, at night generally from 45 to 78 cubic feet of water accumulated in it, which had always to be brought up before the sinking of the shaft could be continued. Some time afterwards the quantity of this water diminished to 13 cubic feet 101 cubic inches, and in the night of the 29th of October, after the shaft was already finished at a depth of 33 feet, and a reservoir (pit) made at the bottom of it, only 9 cubic feet of water had entered it, a measure which afterwards remained tolerably constant, and was only sometimes increased by the continuous and heavy rains in that country which frequently occurred in the late season of the year 1852.

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* See, for example, pp. 36-48 in my work:—"Der wasserreiche artesische Brunnen im alpinischen Diluvium des oberschwäbischen Hochlandes zu Isny," &c. Stuttgart, 1851.

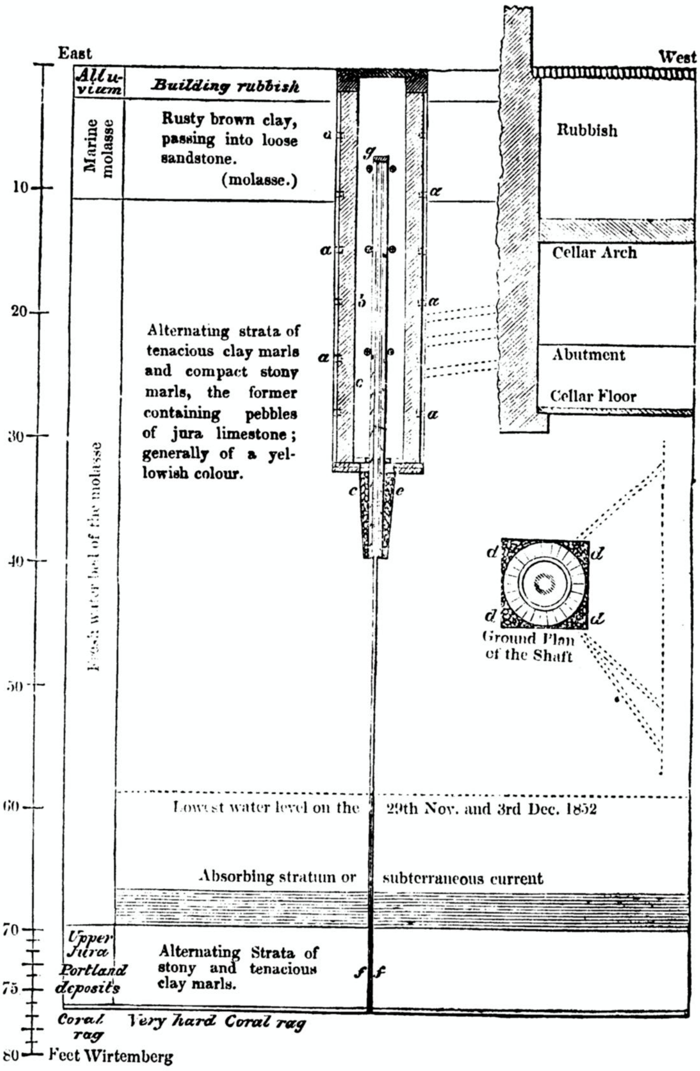
† My original opinion of inorganic and organic springs is to be found in my appendix to the German edition of "Viollet's Théorie des Puits Artésiens." Compare, besides, the singular work:—"Die Räthsel unserer Auellen oder Kritik aller wichtigeren bisher aufgestellten Theorien über den Ursprung, die Perisdicität, die chemische Beschaffenheit der Auellen unserer Erde, &c., &c., von Dr. A. F. P. Nowák. Leipzig (O. Wigand), 1844."

* German: Schildmauer.

The striking diminution of the water at first gave room for the conjecture that the freshwater marls, disclosed at the lower part of the shaft, might already have the capacity of absorbing a part of the water. This opinion, however, was not confirmed: the clay marls in question were compact, and not in the least sandy or porous, and I explain the reason of this phenomenon in the following manner:—

By the sinking of the shaft, the main supply of the percolating water coming from the east was at once cut off; the ground of the fir wood at the back was saturated from the depth of 19 feet to that of 25 feet with water, which found an almost closed dam in the retaining wall of the cellar. At first this water, so dammed up, could pour into the shaft in its maximum quantity, because this watery stratum, six feet thick, was suddenly and vertically laid open by the sinking of the shaft, but by degrees this percolation of the water necessarily diminished, by the continual emptying or draining of the stratum in question, until a normal state of permanence was gradually established.

SECTION OF THE WELL AT THE NEW CELLAR.—Plate II.


East
West
Alluvium
Building rubbish
Marine molasse
Rusty brown clay, passing into loose sandstone. (molasse.)
Rubbish
Cellar Arch
Abutment
Cellar Floor
Fresh water bed of the molasse
Alternating strata of tenacious clay marls and compact stony marls, the former containing pebbles of jura limestone; generally of a yellowish colour.
a
g
b
c
e
d
f
Ground Plan of the Shaft
Lowest water level on the 29th Nov. and 3rd Dec. 1852
Absorbing stratum or subterraneous current
Upper Jura
Portland deposits
Alternating Strata of stony and tenacious clay marls.
Coral rag
Very hard Coral rag
10
20
30
40
50
60
70
75
80
Feet Wirtemberg

Even during the sinking of the shaft, and especially when it was carried down below the bottom of the cellar, a diminution of the water in the latter could be perceived, whilst up to that time it had hitherto always come in through the joints of the retaining wall at different spots, running into the pit placed at *b* (see Plate I.), from whence it had to be pumped out very often. Several spots of this retaining wall which were formerly wet began now to dry up, instead of the water entering as hitherto, and partly washing away the mortar and injuring the masonry.

The boring then began at the bottom of the reservoir formed at the bottom of the shaft, and in clay marls of the fresh-water formation, inclosing many pebbles of jura limestone. This ground was very much inclined to crumble and fall in, and, therefore, I intended to sink wooden tubes, but as it was impossible to get an iron shoe* made in that country, which was absolutely necessary for this purpose, I was obliged to make a virtue of necessity, and, contrary to the technical rules, to set the tubes upon the grounds without a shoe, and without being able to sink them down. I began the boring at a venture, resolved, however, after its termination, to protect the hole against the falling ground by means of metal tubes.

I will not fatigue the reader by technical details; in short, the hole had a diameter of four inches (Wirtemberg); the perforation was carried on as rapidly as possible, and the ground which fell in during the boring was always quickly removed. The water in the shaft, which in the course of the perforation was no longer brought up, accumulated in a large quantity, and rose, as was to be expected, so high, that it even penetrated through the retaining wall again, and flowed on to the bottom of the cellar.

When, on the 26th of November, a depth of 66 feet 7 inches and 3 lines (taken from the upper soil or the way board of the shaft) was attained, the borer, which I happened to be directing with my own hand, sank rapidly down through a stratum three feet deep, filled with sand

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* See Fig. 7 on Table IV. in the work by my father and myself: "Vollständige Anleitung, Fertigung und neueren Nutzanwendung der gebohrten oder sogenannten artesischen Brunnen"

and pebbles of jura limestone, and at the very same moment the column of water in the shaft began to sink, and by degrees, more and more slowly, it disappeared, so that it had completely run out of the shaft during the night of the 26th of November. The water from the shaft could easily enter the bored hole, for the lower division of the wooden tubes had purposely been pierced before being inserted into it, as may be seen in the section on Plate II.

Now, I had found the desired and expected absorbent stratum; or, more properly speaking, I had met with a subterraneous current of water, which would perpetually absorb the water draining into the shaft.

It is essential to remark that this absorbent stratum, the vertical section of which amounts to three feet, is situated in the boundary between the fresh-water bed and the upper jura formation; and this interesting fact confirms anew what I have experienced and maintained on several occasions, viz., that "*positive as well as negative strata, that is, such as supply and such as carry off water, are principally found between the alternating plains of heterogeneous deposits.*"

If I had not been thus early successful, I should have continued the boring with the fullest confidence of finding in the coral rag itself powerfully absorbent cavities, which, if it was necessary, would have been able to receive and carry off a whole brook or rivulet;[*] for what experienced geologist, looking at the geological and hydrographical conditions of Stetten, as above described by me, could have doubted the success of this perforation?

As the subterraneous current of water brought a great quantity of sand and pebbles of jura limestone into the bored hole, I found it advisable to cut through the subjacent Portland bed, and to penetrate a little way into the hard coral-rag, in order by this means to free the absorbent stratum from the pebbles, and thus prevent the future stoppage of it. To clear this stratum completely was of the utmost importance, in order to successful subsequent working. Of this I had an instance in the case of the positive artesian well in the Alpine diluvium which I established in the town of Isny, in the year 1841.[†]

As the water from the shaft and the bored hole flowed into the absorbent stratum with a decreasing velocity, and irregularly—a circumstance occasioned no doubt by the pressure of the pebbles—and besides, on account of the very rainy weather at that time the water entered in greater quantity, it is difficult, nay, impossible, to fix an accurate arithmetical mean of the quantity of the escaping water, though I undertook several very exact measurements. The following experiment gives a general view:—

In order to be convinced of the continuance of absorption of the stratum in question, I ordered, in the afternoon, at two o'clock, of the 30th of November, five Wirtemberg kilderkins, or 62 cubic feet 800 cubic inches of water to be brought and rapidly poured into the bored hole through a pipe, whereupon it found its level in the shaft at a depth of 32 feet 8 inches and 1 line under the way board, rising, therefore, very little above the bottom. After the first four minutes, 7 cubic feet 350 cubic inches of water had escaped; sixteen minutes afterwards, however, 4 cubic feet 900 cubic inches of water had disappeared. In two hours and a quarter 19 cubic feet and 110 cubic inches of the water poured in went off, but it must be observed that, in consequence of heavy showers of rain at that time, a considerable quantity of drainage water entered the shaft, which had to be carried off with the other, and it is therefore impossible to give a correct measurement of it. Soon afterwards the water had entirely left the bottom of the shaft.

This experiment was witnessed, in the absence of the Count of Maldeghem, by his intelligent and active steward, Mr. Keller, mayor of the town of Niederstotzingen, who, in the first instance, fully saw the advantage and probable success of my borings, and who, therefore, gave his strenuous support from the beginning to the end of the work, although several unprofessional men had repeatedly declared the affair a rash undertaking.

(*To be continued.*)

ON THE SECURITY AND MANUFACTURE OF BANK NOTES.

This subject has so frequently occupied the attention of this Society, that the following abstract of a lecture delivered by Mr. Henry Bradbury, at the Royal Institution, will be interesting to the readers of the *Journal.*

In calling attention to the many processes connected with the manufacture of bank-notes, Mr. Bradbury said, his object was rather to direct attention to the consideration of the most important feature in their manufacture, namely, the engraving, because upon it their security in the eyes of the public mainly depended. It was of importance to discuss this question; forgery was on the increase, and difference of opinion existed as to the soundest method for obviating it; facilities were growing up to assist forgery; and, further, there was a tendency to employ that method which in reality was most exposed to the operations of the forger. If we could be sure that the advance of genuine Art must ever distance that of the spurious—if the success of the forger were to stand in an inverse ratio to the genius of the artist—and if we were to ignore the wonderful skill and ability of the so-called uneducated classes—then indeed this subject would lose a considerabte portion of its interest, and its technicality would be deprived of its moral importance.

Had, however, the Report of the Committee of the Society of Arts[*] (though sitting upon this question so far back as 1819) been acted upon, it appeared that this state of things could never have arisen, for they arrived at those sound conclusions which were perfectly applicable at the present day. This Committee was organised in consequence of the rapid increase of convictions for the circulation of Bank of England note forgeries. Juries began at last to feel a reluctance to visit with capital punishment a crime, for the prevention of which no proper precautions seemed to have been taken. The fact also, that forged notes had passed undetected the scrutiny of the Bank inspectors, determined the Society of Arts to take this step. The point for their especial consideration was, to determine the means within the compass of Art, not so much totally to prevent the forgery of Bank of England notes (for that was obviously impossible), as to elicit means of detection by increasing difficulty of imitation.

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[*] The capacity of absorption of a bore may, under certain circumstances, be very considerable, especially if ramified fissures or cavities have been disclosed. Even common absorbent strata or subterraneous currents are sometimes capable of carrying off a large quantity of fluids, and out of some results obtained in France, the following is a proof of what I have just said. It was communicated by M. Arago, in the "Annuaire" for the year 1835, pp. 245-246, and I here give a translation of it:—"A manufacturer of potato starch at Villetaneuse, a little village a league from St. Denis, in the winter of 1832-3, by means of a well bored to the depth of certain earthy absorbent strata, daily got rid of 80,000 litres of foul water, the disagreeable odour of which gave rise to complaints which would probably have compelled him to remove his establishment. After five months' daily absorption the borer found nothing but sand at the bottom of this well, and it has ever since worked as well as at first."

[†] See p. 28 in my work already quoted:—"Der wasserreiche artesische Brunnen im alpinischen Diluvium des obserwäbischen Hochlandes zu Izny, &c."

[*] Report of the Committee of the Society of Arts, on the Mode of Preventing the Forgery of Bank Notes, &c. London, 1819.

That report was one of great value, and remained in these days still further capable of extension, with the aid of a nice judgment, joined to artistic advantages which could now be commanded, to obviate many of the difficulties which originally beset this subject.

The main feature, then, of the note, the engraving, and its security, had been proved in practice, as well as deposed to by artists of eminence, to depend upon the vignette. The higher the quality of the artistic impress, therefore, which the vignette carried—the purer and severer the tone conferred upon its execution—the greater the security of the note. This artistic impress might be still further extended to the whole face of the production.

The great value of the vignette consisted in this, that it was the uncounterfeitable seal of the note—uncounterfeitable, because, though it might be imitated, its individuality could not. Thus, a picture always conveyed the style of the artist, exhibiting a special individuality which no copy could possess.

Rival engravers might produce works of similar beauty and general effect, but the difference of manner would be obvious to the commonest observer, and not only would the forgery be discovered, but the hand that had executed it would be identified. The eye of the banking-clerk or the man of business would soon become expert at this kind of fine art reading. This was proved in the case of the Plymouth Bank half a century ago; their bills were forged—their notes were not, simply on account of the vignette. When the vignette was added to the bills, the forgeries ceased.

Mr. Bradbury spoke of the various methods of engraving, the choice more especially lying between that of *intaglio* and *surface-engraving*, between steel and copper-plate, or letter-press and wood-engraving. Of the two, the first ranked pre-eminent, both for its beauty and adaptibility to the production of bank-notes. The objections as to cost of reproduction and want of individuality no longer existed, the electrotype giving from one original an infinity of reproduction, with little more than nominal outlay.

With regard to letter-press or surface-engraving, Mr. Bradbury considered it incapable of realising a high standard of artistic finish; and that its cheapness, combined with rapidity of production, was not sufficient to counterbalance the absence of continuous and unalterable individuality. Contrary evidence had to be contended against, the notes of the Bank of England, those of the Bank of France, Bank of Belgium, and Bank of Russia, being printed from surface-engraved plates. Such evidence could not countervail the immeasurable superiority of *intaglio* engraving for the main object desired,—namely, security.

In the engraving of the bank note two principles were involved for consideration: first, the *simplicity* of its design, the purity of which was the guage of its perfection; secondly, the combination of vignette-work with intricate engine-work; both these principles possessed high claims to the attention of banking authorities as security against forgery—the one on account of the difficulty of mechanical imitation—the other on the principle of the certainty of a first-sight recognition. Simplicity of design, when it amounted to the character of high-class Art, was much the best with regard to the issue of National notes.

By way of illustrating this principle, Mr. Bradbury submitted an imaginary note of the Bank of England.

This note he considered as simple as a national note could safely be. Its attributes were individual unity, if not beauty; simple and salient features, with due prominency of numerical value.

Breadth of design and unity of purpose were sought for. Care had been taken in the introduction of the ornamentation, that it should not assume a position so prominent as to weaken the artistic effect, but rather serve as an auxiliary to Art.

The Bank of England note had always been characterised by simplicity, but carried to an extreme, the same general design having been preserved from the issue of their first note. The objection was that its simplicity was *too* simple,—not bearing upon the face of it those features which characterised the true Art-point. The vignette was a specimen the reverse of that which had been advocated; it was alike deficient in conception and execution. Surface-printing having been chosen as the medium, the Bank authorities were restricted in the application of their Art. Their great aim had been to secure simple identity and ready recognition through the excellence of the paper, known by its peculiar colour, by its thinness and transparency, as well as by its feel, crisp and tough, patent to the sense of touch alone. The basis of its security to the public rested upon its paper. Successful imitations, however, had been made abroad, and passed in this country. The fallacy of its security consisted in the extreme facility it afforded for reproduction by hand, apart from reproduction afforded either by the Anastatic or Photographic processes. From 1837 to 1854, these notes were printed from steel plates, reproduced by the Siderographic or Transfer process; at the commencement of 1855, a change took place in the production of the notes by the substitution of surface-printing from electrotypes for steel-plate printing. A variation was then made in the form of the old note, by adopting an engraved signature instead of a manual one—the object being still further to strengthen the identity of recognition.

The note of the Bank of France for 100 francs was a fair specimen of surface-printing, but its inferiority of design indicated that it had been adapted to its limited capabilities. The note for 1,000 francs was less exposed to the objections raised against the note for 100 francs, the difficulties of copying by hand being very great. These notes were printed upon both sides at once, effected by pulling an impression on the tympan itself before pulling each impression of the note; the reason for so doing was, that when the impression was pulled upon the face of the note, the paper received two impressions at the same time—the one, on the face of the note from the printing plate—the other, on the reverse of the note, transferred from each impression on the tympan pulled previous to the genuine impression. The two impressions must necessarily register. This course had been pursued with the idea that perfect register of the two printings was a good gauge for detecting imitations. There was some reason in this, as it was a most difficult operation, requiring consummate skill. It was said that not more than three hundred impressions were printed daily at one press—this did not speak much for economical production.

Simplicity of design was not to be advocated as solely applicable to a note in all instances. It was more especially suited for national notes, because immediate recognition should be one of their essential features; but for provincial or local notes, not having so wide a commercial circulating range, the complex note had peculiar advantages; the display of national emblems—ideal impress and intuitive recognition being here unnecessary. One merit in particular which it possessed was, that it was more available to represent small amounts, and for circulation among the humbler classes, for an obvious reason, the repetition of the amount represented affording to the holder a more continued appreciation of its value.

Art was the principle of a simple note; mechanics, or engraving by machinery, that of a complex note. This was performed in two ways: relief and medallion-work, guilloche or rose-engine work. The one represented models on flat surfaces; the other, lines, straight, waved, or curved, circles, ellipses, parallel or intersecting, resulting in a particular effect. Different results were sought in the combinations produced from such machines; some preferred figures white on black, others the reverse. The latter was less confused than the former, its effect more beautiful, and it afforded a much greater probability of detection.

In the instruments used for the execution of these designs (being the laboriously-perfected construction of F. J. Wagner, K.H. Mechanicus, of Berlin), the adjustment admitted such variety that, even allowing the forger to be possessed of a similar instrument, the chances against hitting on the several requisites to produce any particular pattern were infinite. It was possible, he (Mr. Bradbury) thought, to combine, even within this intricacy of pattern and ornament, an idea of simplicity and singleness of recognition.

Mr. Bradbury exhibited a note produced by such means, in which he showed that Art might be made to hold an important place, for idea in design could be seen in its impress, and thus almost the same, if not greater, from its mechanical construction, amount of security might be guaranteed, previously stated to have been the object of *simplicity*. It possessed unity of parts and purposes in design which told much against the imitator. Such a note might be a small and convenient note, and could be divided into four parts, for postal security.

Too much ornamentation was apt to bewilder, nay, misguide—too little, liable to abuse; but a proper combination of a certain amount of elaborate mechanical work, properly balanced to meet the effect of the design, could also combine beauty with security, with hardly less facility of recognition.

The feasibility of this had been lost sight of; indeed, it was not practicable until the electrotype was known. By this power, surfaces of any given dimensions could be multiplied, without reference to the quantity or delicacy of the work; not so by the mode of reproduction known as the siderographic process, for transferring objects from steel to steel. It required retouching, an objection not at all applying to the electrotype.

Since the discovery of the electrotype, efforts had been made to apply its perpetuating power to the reproduction of copper engravings, but in every case with signal failure. The average number of impressions from one plate rarely exceeded 500; the electro-copper, too, spread, from the pressure of the printing-press, and, in addition, from its softness, even curled round the cylinders. Too little attention was paid to the science of electro-deposition. An experiment was made a few months ago, to re-establish in this country (for it has long been in successful operation at Vienna) its practical as well as its economical adaptibility. This experiment was made upon the note of the Bank of Brazil, amounting to 1,200,000 notes, of very elaborate work. At the completion of this work, the means for future production existed for printing as many million notes more as thousands have already been printed. The electro-plates in this instance, partly owing to the increased hardness in the copper deposited, and partly owing to a particular method of treatment, yielded, on an average, 1,600 perfect impressions, and experiments are in course of operation for increasing this to between 3,000 and 4,000. The peculiar advantage of the electro over the siderographic process will be apparent, seeing that the electro copies the whole surface—and furthermore, it copies the exact state of the plates, without requiring the aid of scraper or burnisher, or that careful retouching and deepening of lines so indispensable to the success of siderography.

This is a process for transferring figures from steel to steel, and thus multiplying the number of plates. It is one of exceeding simplicity, but, however simple it may appear, it requires more than ordinary skill to effect successfully that little of which it is capable. It consists in taking up an engraved plate upon a roller of softened steel, a combination of rolling and pressure. The engraved subject thus stands in relief upon the roller. Identical plates are thus said to be produced. The objections are threefold—first, every subject so transferred must be subsequently retouched by the graver; secondly, its transferring properties are limited to very small subjects; thirdly, and as a consequence, it is inapplicable to the manufacture of complex notes.

It has been in use for thirty years or more in America; in fact, it was the invention of an American; but the notes of the United States Government are not, and never have been—beautiful as their execution is—carried out after the principles advocated above. Referring to the American notes, it is a curious fact that, America being divided into so many States, and each State being represented by a different note, forgers did not think it worth their while to imitate, and therefore concocted notes of their own.

In the bank-notes of other countries there is an entire absence of all those qualities which have been insisted upon, and actually, in many instances, they appear to offer a premium to forgery.

The notes of the United States present specimens of the highest order, but the subjects selected seem irrespective of their purpose, and the multiplicity of the figures distracts the attention. The Austrian notes fall considerably below the standard of American excellence. Prussian notes, too, partake of the same objections—preserving, in many instances, the appearance of fancy stationery. The Russian notes might well be adopted for merchandise labels.

Great reliance for security was placed upon a combination of processes, and the greater the number employed in their construction—the more different the effect resulting from each—the more difficult it was supposed for the power of a single forger to embrace the exercise of the whole. This was a fallacious dependence, for the confusion created tended to less particularity of observance upon the part of the public.

The question of security was one of most difficult solution. It was said that what has been executed by one individual may be copied by another; and it was not in the nature of things that a person who cannot read, should be protected from imposition by the most clumsy forgery. Science affords facilities for the reproduction of almost everything; while she helps the producer, she does not withhold her help from the imitator. The first reason Mr. Bradbury could not admit as valid, and the general spread of education disposed of the second.

Mr. Bradbury, while he admitted the great value and capabilities of the anastatic process as a means of copying, yet thought it was incapable of reproducing very fine copperplate work. Here, then, was security against its use in reference to notes. Again, with reference to photography. Up to the present time it had not been made available for the production of a perfect copy, but great advances have been made. A process had lately been discovered capable of producing a more serious result than that previously obtained; namely, a printing-plate.

Printing in different colours, superposed, presented almost insuperable difficulties in the way of copying by the anastatic or photographic processes. These processes, however, must not be disregarded.

If no notice be taken of them by bankers, if forgers perceive that increased facilities for copying are not met by increased efforts to defeat them, such indifference only gave encouragement for cultivating forgery as a science.

The water-mark was not regarded as unimportant, though secondary to the main consideration; for a successful copy of a good engraving upon a spurious water-mark was more likely to impose upon the ignorant, than an inferior engraving upon the genuine water-mark. If then the water-mark were backed by the excellence of art and engraving, it might safely be asserted that the bank note was unforgeable. But it may be said, if the paper thus alone furnished an absolute security, why make so great a parade of art, design, engraving, &c., in its manufacture? Because, whatever internal security existed in the paper, tended rather to the security of the bank. There should also be a *primâ facie* security for the public; and if both are applied, they re-acted upon each other, and the note was perfect.

Mr. Bradbury concluded by saying, "Let art be impressed upon the note. Let ingenuity of design, executed by a hand whose genius would at once indicate its authority, be adopted so far as is consistent with a commercial purpose. Let that mode of printing be employed which alone can render the delicacy and force of an art-subject. If this course be followed, the greatest possible amount of difficulty would be placed in the way of reproduction by hand; the two scientific processes referred to cannot be brought to bear against it—and further, which should be another grand object, this art-education of the people would eventually teach them prudence in distinguishing the genuine from the false."

PUBLIC HEALTH.

The following is extracted from the Registrar-General's last Quarterly Report:—

"At this season of the year, when many people are travelling on the continent, as well as in England, it may be useful to state that it is now well established, by extensive observation, that England is the healthiest country in Europe. France stands next to England in salubrity. In the continental cities the annual rate of mortality is seldom less than 30 in 1,000; and the rate frequently rises to 40 in 1,000. In London the rate of mortality is 25 in 1,000.

"On an average of ten years (1841—50) the mortality was at the annual rate per 1,000 of 15 in three English districts, 16 in 14 districts, 17 in 47 districts, 18 in 87 districts. These facts prove that the climate of England is eminently salubrious; and it has not yet been shown that the climate of any part of the continent is equally or more salubrious than this island, crowned with hills of moderate elevation, sloping towards the east and the south; bathed by the showers of the Atlantic, drained naturally by rivers running short courses to the sea, cultivated more extensively than other lands, and producing those unequalled breeds of sheep, cattle, and horses, which flourish only in healthy places.

"The healthiest parts of England are not yet places of general resort, but the annual mortality in the various districts comprising watering-places seldom exceeds 21 in 1,000 of the population, and is probably lower in those regions of the districts to which visitors resort. Hastings, Brighton, the Isle of Wight, Worthing, Mutford (including Lowestoft), Newton Abbot, Barnstaple (including Ilfracombe), Bath, and Cheltenham have experienced low rates of mortality during the spring quarter; and it should be always borne in mind in selecting places of resort that, through the peculiar nature of zymotic diseases, places usually healthy are periodically visited by epidemics, which can only be avoided by consulting recent returns, or by actual inquiries on the spot. The cleansing and the sewerage of all watering-places require improvement, as their arrangements were made when sanitary science was at a low ebb."

ROYAL SCOTTISH SOCIETY OF ARTS.

At at a meeting held on Monday, 14th July, 1856, Professor George Wilson, M.D., F.R.S.E., President, in the chair, the following communications were made:—

1. On the Manufacture of Ropes and Paper from the Stem of the Hollyhock. By Mr. James Niven, gardener to Wm. Stirling, Esq., of Kier. Communicated by the President. Specimens, in illustration, were exhibited.—This invention relates to the application or employment and use of the common garden hollyhock, or the *Althea rosea* of Linnœus, and other plants in the natural family *Malvaceæ*, in the manufacture or production of the pulpy material or fibre from which paper is to be made, as well as in the manufacture or production of fibrous material for textile purposes. In the adaptation of these plants, or their varieties, they may be used either in a green or dried state; they are prepared by being broken up by any of the ordinary means as hitherto used for the disintegration of vegetable fibres—the whole plant being suited, after disintegration, for the production of pulp for the manufacture of paper. Its adaptation as a substitute for rags and other materials now used will be easily demonstrated. 1. Because of the bulk of pure available fibre it produces, the stems attaining the height of from eight to ten feet, even under ordinary cultivation, the only loss in weight being in the separation of the mucilaginous matter which they contain. 2. Because of the permanency of the crop, and the tendency of the root to stool like the willow, thereby producing with its age a greater number of stems, the strength of which may be easily upheld by the application of portable or liquid manures. When the crop requires renewal, the roots, which contain a large amount of farina, should be bruised in the manner of making starch from the potato, and the fibre left is at once suited for the fabrication of a quality of paper even stronger than that which can be produced from the stems; the farina being also available either as a substitute for starch or food for animals. It is also known that the hollyhock contains a large amount of colouring matter, which, being little inferior to indigo, might also be extracted, and thus the whole plant appropriated to useful purposes. Its suitability for the manufacture of rope is alone sufficient to cause it to be extensively cultivated, an acre of plants, when established, producing from three to five tons of available fibre for this purpose. The average quantity of fibre suited for the paper manufacture per imperial acre will be about fifteen tons; this arises from the inner part of the stem being pulped down with the outer fibre.

2. On the Swedish Safety Lucifer-Match. Communicated by the President. The match was exhibited.—The safety lucifer-match is the invention of Lundstrom, a Swede, who has a large match manufactory at Jonkoping, in Sweden, where some hundred workmen are employed, and eight or more millions of matches are produced daily. They are about to be introduced into this country by the firm of Bryant and May, London, who are the largest importers of German and Swedish lucifers in the kingdom. A patent has been taken out in their name for the sale in England of the Swedish match. Its peculiarity consists in the division of the combustible ingredients of the lucifer between the match and the friction-paper. In the ordinary lucifer, the phosphorus, sulphur, and chlorate of potash or nitre, are all together on the match, which ignites when rubbed against any rough surface. In the Swedish matches these materials are so divided that the phosphorus (which is employed solely in the amorphous state) is placed on the sand-paper, whilst the sulphur, and a minimum amount of chlorate, or nitrate of potash, is placed on the match. In virtue of this arrangement, it is only when the phosphorised sand-paper and the sulphurised match come in contact with each other that the ignition occurs. Neither match nor sand-paper, singly, takes fire by moderate friction against a rough surface. The matches are thus much less liable to cause accident by casual ignition than the ordinary ones; and the recent edict by the Spanish Government against the employment of lucifers by the peasantry of the forest districts in dry weather (which will certainly be evaded) would be needless, if the Swedish matches were in general use. If they fully answer the announcements of the inventor, and it is due to him to acknowledge that they excited great interest at the Exhibition in Paris last summer, they will soon displace the common lucifer, in virtue alike of their manufacture being much less injurious to the health of the workmen who make them, and to the property of those who use them.

3. Description of an Apparatus for Seeing Through Tubular Drains from the Surface of the Street. By James Leslie, Esq., C.E., Vice-President R.S.S. Arts. A model and drawings were exhibited.—The apparatus exhibited, which may be considered as a model on half the scale which it would be expedient to adopt in practice, is for the purpose of affording the means of seeing, from the surface of the street, through underground tubular drains, which are too small for a person to pass through, and thereby enabling the observer, without his requiring to go down into any underground chamber, by looking towards a lamp or candle lowered down to another point in the line of drain, to see whether there be any sediment or other obstruction in the portion of the drain between him and the light. This is effected by looking down, with the help of a telescope of small power, to a mirror, set at an angle of forty-five degrees in the lower end of a light metal tube, say six inches diameter, and lowered down from the surface of the street to the axis of the drain-pipe, through a fixed vertical pipe or eye, a light being lowered down another and similar vertical pipe, whereof there must necessarily be one at every bend or change of gradient in the drain.

4. Suggestion for the introduction of the Parisian "Crochet," for the use of street-porters. By Colonel Graham Graham of Jarbruck, Moniaive.—This was a suggestion for the introduction, for the use of street-porters, of what, in Paris, is called a *crochet*, a very simple and cheap contrivance (as one can be constructed for 2s. 6d. to 5s.), curved on the back, which has the effect of throwing the load off the spine, and causes it to rest on the limbs, thus enabling the porter to travel much more comfortably even under a greater load that that usually carried in this country.—Mr. Sang remarked that a somewhat similar machine, of even simpler construction, was in daily use in Constantinople, and that it was astonishing how great a load a Turkish porter can carry, the pressure been thrown entirely upon the limbs and not on the spine.

Home Correspondence.

DR. APELT'S METHOD OF PRESERVING WOOD.

Sir,—We beg your indulgence for a few remarks upon the article which appeared in your last number respecting a process for the preservation of wood, suggested by Dr. Apelt, of Saxony.

We do not wish to discuss the principle of Dr. Apelt's invention. The theory upon which it is based is not a new one. All the timber-preserving processes in which chemical salts have been the agents employed, viz.—Kyan's, Margary's, Payn's, and Sir W. Burnett's, have been founded upon the two following ideas:—

1st. That the tannin of wood has a chemical affinity for certain salts, which, uniting with it, form an insoluble compound, preventing the admission of air and moisture; or, 2nd. The opinion of Sir Humphrey Davy, that a chemical salt which would produce a coagulation of the albumen, would obviate the liability of timber to decay. All these processes, however admissible in theory, and though, to a certain extent, and under certain circumstances, efficacious, have been more or less abandoned in practice.

As the Dr. states, "humidity withdraws the substance again," and we have yet to learn whether this is not the case with his own process, or whether the "slowly progressing mineralisation," of which he speaks, is of a more durable nature, and of a practical and economical application.

But we are astonished that Dr. Apelt has not alluded to the process which has been, of all others, the most extensively and the most successfully adopted. The process of *creosoting* timber is so well known to the engineering world in England, that it will not be necessary to enter into a lengthened description of it here. It will suffice to mention that it does not change the nature of the wood, as was attempted to be done by the other methods. It introduces an antiseptic substance into the pores, taking the place of the natural sap, and thoroughly impregnating the texture of the timber wherever it enters. It prevents the formation of the fungi-producing rot, whilst, from its bituminous and oleaginous nature, it forms an impenetrable sheath against the access of those formidable agents of the destruction of woody fibre—air, humidity, and the attacks of insects.

This process is now of almost universal adoption for railway and other great public works in England, and is very extensively used on the Continent. It has stood the test of time and experience for a period of more than fourteen years, without a single recorded instance of failure when the process has been properly carried out. We have but to cite, amongst numerous other instances, the case of the Scotch fir sleepers, which were creosoted and placed on the Eastern Counties Railway in 1842, and which were exhumed during the present year, without presenting the slightest appearance of decay.

We think, therefore, we are justified in commenting upon the circumstance, that Dr. Apelt ignores the existence of a process which completely carries out the end which he proposes, and which is of such general application; and we fearlessly join issue with him on his conclusion, that all other processes but his own are transient and incomplete in their operation, and of too recent a date to produce reliable results.

In conclusion we beg to say that, as contractors, who have been engaged for many years past in carrying out, both in England and on the Continent, the various processes which scientific men have from time to time invented for the preservation of timber, we do not presume to put forth our own opinion merely on this important subject. If we cite the fact of one process being adopted in preference to another, it is because the concurrent judgment, observation, and experience of the leading engineers of the age has directed our labours in that direction, and practically solved the problem whether timber exposed "between wind and water" can be effectually preserved from decay.

We are, &c.,
H. P. BURT and CO.

P.S.—The process of creosoting timber is fully described in the "Formules" of Mons. J. Claudel, a text book for engineers, much referred to on the Continent.

INTERNATIONAL CURRENCY.

Sir,—Your *Journal* has claims to be regarded as a depository of information on this and cognate subjects as they transpire.

It is reported from Vienna that the Prussian representative at the Monetary Congress there, Finance-Councillor Seydel, has gone to Italy with a view still further to extend the relations now proposed to be established between the German standards of weight and value on the one hand, and those of the French metrical system on the other.

Those who have retarded the decimalisation of our own established moneys, weights, &c., in the vain hope to establish identity among the currencies of all nations, will probably feel disappointed that nothing more is likely to be attained, notwithstanding that several conventions have been held for reducing the discrepancies among the monetary systems of Germany, from 1690 down to the present day.

In 1838 the Dresden Convention effected a certain correspondence between the divers coins, and rendered them conveniently commensurable by each other; still, for the several reasons given in my paper in your *Journal* of 16th February, 1855, the Convention could neither ensure uniformity at the divers mints, nor enforce the indiscriminate reception of national coins beyond their own frontiers.

It was, nevertheless, an important step gained when, disregarding the disparities acknowledged to exist between the mark weights of German states, so many of those states adopted the Cologne mark as a common mint standard. Thus, since the Dresden Convention above referred to, the Cologne mark of pure silver has been at once the contents, equivalent expression, or common value of—

14 Prussian thalers.
21 Austrian florins (old).
20 Do. do. since 1838 (C. M.)
24$\frac{1}{2}$ Rhenish florins.

Of late years the German Customs Union (Zollverein) has adopted for international purposes a zoll-centner, or cwt. of 100 French $\frac{1}{2}$-kilogrammes, or zoll-pounds; and Prussia, since the 1st July current, adopts the same weight for its internal trade. It is now proposed to substitute this zoll pound for the Cologne mark, as a standard mint weight.

In order to facilitate this arrangement, Austria contemplates reverting to her old florin, of which 21 = 14 Prussian thalers. The following would then represent the scale of equivalents:—

A zoll-pound, or $\frac{1}{2}$-kilogramme of pure silver, would be coined into

30 Prussian thalers.
45 Austrian florins.
52$\frac{1}{2}$ Rhenish florins.
111$\frac{1}{9}$ French francs.

The debasement of the German standard of value, to be caused by this alteration, has been much exaggerated by rumour. Since the Cologne mark is estimated by the French mint at 233·855 grammes (the Germans claim for it 233·860 grammes), I estimate that it will require from 100,223 to 100,225 of any of the proposed new German coins to produce as much pure silver as is contained in 100,000 of the existing coins. In other words, the German monetary standard would be debased to the extent of, say 2$\frac{1}{4}$ per mille, *i.e.*, 4s. 6d. per £100.

For estimation of the par of exchange, the following table of equivalents may be found useful:—

1000 francs.
270 Prussian thalers.
405 Austrian florins.
472$\frac{1}{2}$ Rhenish florins.

That "fixed equivalents" between the silver standards of Germany, France, &c., and the gold standards of Great Britain, the United States, &c., are a mere chimera, should, after the discussions in your columns, be obvious to all. Still, as a convenient datum, the artificial par of exchange, 25 francs per £1, supplies the following tables:—

		1000ths of £1.
1 franc	=	40
1$\frac{1}{80}$ P. thaler	=	150
1$\frac{1}{80}$ A. florin	=	100

In other words, 1 Prussian thaler, plus 1$\frac{1}{4}$ per mille, equals 3 shillings, or, more correctly, $\frac{3}{20}$ths of £1, *i.e.*, 150 English mills; and the Austrian florin, plus 1$\frac{1}{4}$ per mille, equals the $\frac{1}{10}$th of £1, represented by the English florin, *i.e.*, 100 mills:—

ARTIFICIAL PAR OF EXCHANGE.

25 francs	per	£1
6$\frac{3}{4}$ P. thalers	per	do.
10$\frac{1}{8}$ A. florins	per	do.

The extension of the sphere of the kilog. should rejoice all those among the advocates of international standards who will condescend to be practical, and abstain from insisting that we shall never be enabled to compute English moneys, weights, &c., by simple or common arithmetic, until the nations of the earth shall have submitted their cherished standards to some procrustean process yet to be devised.

Let them be content with the simplifying of relations between weight and measure standards of old countries, expressed by some accepted formulæ of equivalents in international commerce. Perchance in time (as with Prussia, if its new plan effect the object in view) international standards may become domestic ones also.

Meanwhile, I have already shown, in your *Journal* of 15th Feb., 1856, that Great Britain, her colonies, the United States, and other exporting countries using the ℔ avoirdupois of 7,000 grains, will find 63 cwt. avoir. equivalent to 64 cwt. of the Zollverein, *i.e.*, 3,200 kilogs., and 441lb. avoir. equivalent to 200 kilogs., within a mere $\frac{1}{60}$ per cent., and I maintain, once more, that to decimalise the £ and the ℔, would be intermediately necessary, even though international standards were near at hand.

Yours, &c.,
J. A. FRANKLIN.

Warnford-court, 31st July, 1856.

NEGATIVE ARTESIAN WELLS.

SIR,—In an article on "Negative Artesian Wells," by Dr. Bruckmann, in the last two numbers of the *Journal*, I find the author taking great credit for introducing the subject of absorbing wells as a novelty in this country.

If he will be good enough to refer to the second volume of a work on Geology, published by me in 1844, he will find the subject referred to, and illustrated by engravings, in fewer words indeed than those he has now used, but perhaps clearly enough to convince him that England is not so much behind-hand in this matter as he supposes. The reference alluded to is in page 503, and suggests an employment of absorbent wells to which your correspondent does not allude.

I remain, &c.,
D. T. ANSTED.

17, Manchester-street,
August 1, 1856.

EDUCATION FOR GIRLS.

SIR,—Education is much indebted to Lord Ashburton for his introduction of the phrase "*common things.*" His lordship might have advanced another step, by asserting that the commonest things depend upon science for their due and economical execution. The Dean of Hereford obtained scientific instruction for the school at Kingsomburn. Dr. Booth has likewise succeeded in introducing it for boys; and Professor Henslow has taught it to girls as well as boys, as noticed in the *Gardener's Chronicle* for the last and present month; but these are, it is believed, the only instances of scientific instruction being afforded to the poorer classes of children. And yet how useful it is in the most ordinary operations. For instance, in making tea, chemistry teaches us that the aroma of the beverage being an essential oil, it evaporates at a boiling heat, and, therefore, the water used should not be allowed to attain that heat; whilst, on the contrary, teaine is best extracted at a boiling temperature. About a century ago, Sir Humphrey Davy, in a lecture delivered at the Royal Institution, said that a silver teapot made better tea than one of Wedgewood's ware, but he knew not why. The radiating powers of polished surfaces have since then been discovered. Cooks soon ascertain that a black saucepan heats quicker than a bright one; and thus endless might be the proofs of the necessity of applying chemistry to "common things."

I am, &c.,
M. S. BENTHAM.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette August* 1*st*, 1856.]

Dated 15*th July*, 1856.

1658. Jean Louis Lucas and Albert de Briges, Paris—Improvements in preparing certain liquid or solid alimentary substances from the husk of a certain fruit.

Dated 16*th July*, 1856.

1668. William Schmidt and Edward Schmidt, Heidelberg, Baden—An improved balance for weighing.

1670. Henry Turner, Leeds—Improvements in cutting hides for making flexible pipes, and for certain other purposes.

1672. Alfred Vincent Newton, 66, Chancery-lane—Improved apparatus for obtaining rotary motion. (A communication.)

1674. Thomas Duncan, Liverpool—A combined and compound engine for applying motive power, and for measuring fluids.

1676. Duncan Cameron, Glasgow—Improvements in cranes or lifting and lowering apparatus.

1678. George Eskholme and Henry Wilkes, Rotherham—Improvements in ball cocks and cocks in general for drawing off fluids.

Dated 17*th July*, 1856.

1680. Charles Barlow, 89, Chancery-lane—An improved surveying instrument. (A communication.)

1681. Henry Bragg, jun., Belfast—Improvements in drying air, and in machinery for stretching, drying, and finishing fabrics.

1682. Frederick Andrew and Samuel Forsell, Manchester—Certain improvements in machinery or apparatus for sizing, stiffening, dressing, and polishing yarns and threads.

1684. Rev. George Jacque, Auchterarder, Perth, N.B.—Improvements in the construction of stringed musical instruments.

1685. Ebenezer Seymour, Blomfield, New Jersey, U.S.—Improvements in the construction of furnaces. (A communication.)

1686. Alfred Vincent Newton, 66, Chancery-lane—An improved regulator for heating apparatus. (A communication.)

1687. Charles Carey, 48, Bessborough-street, Pimlico—Improvements in the vessels and filters used for making infusions of coffee and other substances.

Dated 18*th July*, 1856.

1689. Samuel Jay and George Smith, 246, Regent-street—Improvements in the manufacture of skirts, petticoats, mantles, and such like articles of ladies' dress.

1692. George Frederick Hipkins and John Britten, Birmingham—Improvements in applying springs or weights for the purpose of closing doors, or resisting shocks, strains, or pressure.

1693. John Cowley, Quenington, Gloucestershire—Improvements in the manufacture of paper from straw and other vegetable substances.

1694. Peter Hubert Desvignes, Lewisham—Improvements in machinery for scutching or beating flax, hemp, and other fibrous materials requiring like treatment.

1695. Jean Gerber, Mulhouse, France—Improvements in printing, dyeing, or impregnating fabrics, yarns, and threads, and in preparing metallic and other powders to be used for these purposes.

1696. William Beevers Birkby, Upper Rawfolds Card Works, Cleckheaton, near Leeds—Improvements in filleting and fixing pointed teeth in the fillets used in the preparation of flax, tow, hemp, and other fibrous substances.

1697. John Hamilton, jun., Liverpool—An improvement in the bending of sheet iron for the manufacture of conical tubes.

Dated 19*th July*, 1856.

1698. William and James McMaster, Manchester—An improved apparatus for retaining and releasing cords of window blinds, or cords, bands, or chains employed for other purposes.

1699. George Hopper, Houghton-le-Spring Iron Works, Durham—Improvements in railway pins or spikes.

1700. John Armour, Kirkton Bleach Works, Renfrew, N.B.—Improvements in bleaching, washing, or cleansing textile fabrics and materials.

1701. James Lawrence Crockett, West Ham—Improvements in evaporating. (A communication.)

1702. William Noton, Oldham, Lancaster—Certain improvements in self-acting mules, and other machines of the like nature for spinning and doubling.

1703. James Ryder and Samuel Bentley, Bolton-le-Moors, Lancaster—Improvements in machinery and apparatus for folding and measuring fabrics.

1704. William Stettinius Clark, 19, Warwick-street, Charing-cross—Improvements in machinery or apparatus for digging, pressing, and moulding peat. (A communication.)

1705. James Lawrence Crockett, West Ham, Essex—Improvements in the manufacture of sulphuric acid. (A communication.)

1706. John Whitehouse, jun., Birchall-street, Birmingham—Certain improvements in making, mounting, and spindling knobs, applicable for doors and other purposes.

1707. William Astbury Jump, Moulton, near Northwich—Improvements in the manufacture of salt.

1708. William Astbury Jump, Moulton, near Northwich—Improvements in apparatus for supplying with fuel the furnaces of steam boilers and other furnaces, and in the method of cleaning the fire-bars thereof.

1709. John Smith, Oldham, and Enoch Harrison, Manchester—Improvements in machinery or apparatus for warping and beaming.

1710. Edward William Young, 22, Maidstone-road, Rochester—Improvements in the construction of bridges.

1711. William Papineau, Harrowbridge, Stratford—An improvement in the production of spirits of wine.

1712. Richard Archibald Brooman, 166, Fleet-street—An improved method of supplying air to gas and other lights. (A communication.)

1713. Henry Jeremiah Iliffe and James Newman, Birmingham—Improvements in the manufacture of buttons.

Dated 21*st July*, 1856.

1714. James Warren, John Jones, and Benjamin Crowther, Clapham-road—An improved churn.

1716. Marc Antoine Augustin Gaudin, and Eugène Xavier Choumara, Paris—Manufacturing factitious wholesome milk.

1718. John Pursloe Fisher, Edgebaston, near Birmingham—Improvements in cues used at billiards, bagatelle, and other similar games.

1720. Robert Richardson, 26, Great George-street, Westminster, and Jonathan Edwin Billups, Llanelly, South Wales—Improvements in the permanent way of railways.

1722. Frederick Simpson, Redhill, Surrey—An improved mode of stopping bottles.

1724. William Green, York-street, City-road—Improvements in treating, ornamenting, and waterproofing fabrics, and in machinery or apparatus for effecting the same.

1726. Samuel Statham, Islington, and Edward Orange Wildman Whitehouse, Brighton—An improvement in the arrangements for or working of electric telegraphs.

Dated 22*nd July*, 1856.

1728. Alfred Vincent Newton, 66, Chancery-lane—Improvements in machinery for reaping and mowing. (A communication.)

1730. Samuel Colman, Norwich—Improvements in steam boilers.

1732. Charles Cowper, 20, Southampton-buildings, Chancery-lane—Improvements in lighting and extinguishing gas lights. (A communication.)

1734. Henry Hindle, Cavendish-street, Ashton-under-Lyne—Improvements in valves and apparatus for governing steam-engines, and for increasing the safety of steam-boilers.

1736. John Imray, Bridge-road, Lambeth—Improvements in bending timber.

Dated 23*rd July*, 1856.

1738. John Brayshay, Cinderhill, Ringley-bridge, near Bolton-le-Moors—Certain improvements in boilers for generating steam.

1746. Giles Mabie, Rockford city, Winnebago county (state of Illinois), U.S.—Improved machinery for mowing and reaping. (Partly a communication.)

1750. John Webster, 1a, Moreton-terrace, Pimlico—Improvements in distilling and treating rough turpentine and resinous matters.

1752. Pierre Charles Prévot, Agen, France—An improved railway break.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

1742. John Onions, Wellington-place, Blackfriars-road, Southwark—Improvements in the manufacture of iron.—23rd July, 1856.

1792. Robert Thatcher, Oldham—Certain improvements in preparing for doubling or spinning cotton or other fibrous substances.—29th July, 1856.

WEEKLY LIST OF PATENTS SEALED.

Sealed July 31*st*, 1856.

257. Henry Holford and Mark Mason.

Sealed August 1*st*, 1856.

311. Theodore Bergner.
321. John Fletcher and William Fletcher.
327. James Edward Duyck.
431. John Freer.
435. Jeremiah Clark and James Austin.
447. James Durell Greene.
459. George Toucas.
499. Peter Armand le Comte de Fontainemoreau.
505. Thomas Taylorson Jopling.
567. Auguste Neuburger.

Sealed August 5*th*, 1856.

318. George Napier and John Miller.
328. Charles Frederick Philipp Funcke.
364. Louis Vignat.
368. William Gilchrist.
370. William Edward Newton.
374. Gustave Louis Keller.
378. Henry Robert Ramsbotham and William Brown.
398. William Edward Newton.
406. James Strang Thomson and Andrew Barclay.
494. Richard Archibald Brooman.
548. Richard Archibald Brooman.
570. John Downie.
931. George Thompson.
998. Thomas Hill.
1076. Louis Guillaume Perreaux.
1088. Alfred Vincent Newton.
1150. James Leck and Alexander Miller.
1252. Alphonse Réné Le Mire de Normandy.
1266. Frank Clarke Hills.
1326. Frederick Albert Gatty.
1350. Charles Durand Gardissal.

PATENTS ON WHICH THE THIRD YEAR'S STAMP DUTY HAS BEEN PAID.

July 28*th*.

1775. James Edward McConnell.
1823. Charles Butler Clough.
1843. Robert Morrison.

July 29*th*.

1779. William Thomas Henley.
1789. John Carvalho De Medeiros.
1852. William Rowan.

July 30*th*.

1822. George Armitage.

July 31*st*.

1897. John Perkins.

August 1*st*.

1825. Thomas Moss.

August 2*nd*.

1829. William Smith and Thomas Phillips.
1831. William Smith and Thomas Phillips.
1887. Richard Archibald Brooman.